

(7) The establishment of a solar physics observatory for the systematic examination and study of the changes in progress in the sun and their correlation with the larger features of Indian meteorology and the transfer of the Magnetic Observatory at Colaba and the Astronomical Observatory at Madras from provincial to imperial control.

The present work of the department and the chief directions in which extension is desirable may be classified under the following heads:

(1) The collection of accurate meteorological data from a sufficient number of representative stations to give the chief facts of the climatology of India and to furnish data for the issue of the various reports and warnings of the department.

(2) Special meteorological investigations.

(3) Seasonal forecasts.

(4) Marine meteorology.

(5) Daily weather reports.

(6) Issue of flood and storm warnings.

The work under the second head admits of very large and special development. Little or nothing is known of the depth of the seasonal atmospheric currents in India. Kite or balloon investigations are hence greatly to be desired. Similarly the relations of sun spots and terrestrial magnetism to Indian meteorology are deserving of a full and careful investigation, for which there is probably sufficient accurate material to enable these questions to be usefully discussed.

A reference to my opinion given in 1878 expresses fully the directions in which I believe now, as then, extension of observation and comparison is necessary in order to increase the value of the seasonal forecasts. Slight extensions have been slowly and tentatively made during recent years, but if further improvement be desired it will be necessary to collect and compare data from a much wider area than has hitherto been possible with the limited available means.

The opinion given in 1878 by Mr. Eliot had reference to "the coordination of the meteorology of India with that of the various countries adjoining the Indian Ocean, and also with that of Europe," for the purpose of studying the two great monsoon currents of India and their possible relation to the variations in the annual rainfall in India, as well as the relation between these variations and the solar radiation and the evaporation over the area which forms the source of the rains of south Asia.

This illustrates the broad policy upon which the Indian Meteorological Office has been conducted during the administration of Mr. Eliot. It is the same as the policy that has led to the expansion of our own Weather Bureau to include reports from the Atlantic and Pacific oceans, Canada, Mexico, Central America, and the West Indies, and from such expansions meteorology is deriving decided benefit.—H. H. K.

PAMPHLETS RELATIVE TO WETTERSCHIESSEN.

No. 1. G. Suschnig. Bericht über den Verlauf des dritten internat. Wetterschiess Congresses zu Lyon am 15, 16 und 17 November, 1901.

No. 2. G. Suschnig. Referat über die Erfolge und Beobachtungen beim Wetterschiessen in Oesterreich erstattet dem III. internationalen Wetterschiess Congress in Lyon am 15 November, 1901.

No. 3. Rudolf Szutsek. Bericht über das Wetterschiessen im Landes-Schiess-Rayon zu Windisch-Feistritz, in den Jahren 1900, 1901. Bearbeitet von Rudolf Szutsek, k. u. k. Oberstlieutenant I. R. Leiter des obigen Landes-Schiess-Rayons. Graz, 1901.

This pamphlet of 16 pages and 2 charts contains a most satisfactory detailed account of the methods and operations at the headquarters of the hail shooting system. It contains the results of careful observations of the hailstorms and of the effect of the shooting. The charts show the irregularity in the distribution of hail from the ordinary storms as well as the irregularities in the movements of these storms, of which there were 8 in 1900, and 7 in 1901. We should say that just as Dyrenforth's explosions of dynamite were observed to be followed by rain, or accompanied by rain, or preceded by rain, according as the observers happened to be in front of, or under, or in the rear of a passing shower, thereby demonstra-

ting its utter inefficiency, so with the cannonading and the hail at Windisch-Feistritz. However, on this latter point Lieutenant Szutsek, on page 14, says:

Although no certain conclusions can be drawn from the previous observations because we have too little material on hand, still the results give some ground for the hope that the question whether hail shooting is efficacious, whose solution the whole world awaits with anxiety, can be answered in the near future.

No. 4. G. Suschnig. Das Wetterschiessen. Graz. 1901.

This is a very interesting general history of the subject from 1750 to May, 1901. It gives an excellent bibliography of the subject and is apparently prepared for distribution at the Congress at Lyons.—C. A.

THE THIRD INTERNATIONAL CONGRESS ON HAIL SHOOTING.

On a following page we publish a translation of the whole of the report offered to the Third International Congress at Lyons in November last, by Prof. J. R. Plumandon, Director of the Meteorological Observatory on the Puy-de-Dôme in southern France. The extent to which cannonading against hail has spread through Italy, Austria, and France is well shown by the reports presented at the Congress at Lyons. The general report of the proceedings of the congress has been prepared by G. Suschnig, the indefatigable agent of the iron manufacturing firm of Carl Greinitz and Nephews at Gratz, Austria. According to this publication reports were received at the congress from the following persons:

1. Professor Battanchon on the general history of the subject of weather shooting.

2. Guinand, on the results in France, during 1901, where 39 operators with 834 cannon protected 22,900 hectares. He reported perfect success in every case; on this Suschnig remarks that he is altogether too optimistic, and that his enthusiasm needs to be modified by a careful discussion of the French data such as has already been done for Austria.

3. Suschnig, a general report for Austria. After a short sketch of the literature of the subject since 1750, in Austria, he gives a special description of the present state of affairs in the various provinces of Styria, lower Austria, Krain (Carniola), the Adriatic coast, Dalmatia, upper Austria, the Tyrol, and the Kaernten (Carinthia). In summarizing the results, he states that they have investigated thoroughly the efficiency of the cannon, and the altitude to which the vortex rings ascend, viz., three or four hundred meters. They have also begun a laborious investigation, as yet unfinished, into the laws of the movements of the vortex rings. He is endeavoring to respond to the general demand for accurate data as to the operations themselves. In general, every one is thoroughly satisfied with the results and no one doubts but that systematic shooting has accomplished good results.

4. Konkoly, for Hungary. The experience of the year has shown that the practical service leaves much to be desired, and the reporter, therefore, expresses the greatest reserve in judging of the value of the shooting.

5. Ottavi, for Piedmont, Italy. Although there were many hailstorms yet the stations were generally well protected, but there were three cases of severe extensive damage to the protected as well as the unprotected, namely, on May 17, June 12, and July 22. In many cases the shooting seems to be effective against hail, but in many others not so.

6. Alpe, for Lombardy. The shooting stations generally report good results, but cases of failure are believed to be the consequence of poor organization, feeble cannon or delay in shooting; nevertheless the severe misfortune at Mantua occurred in spite of perfect shooting and can not be excused.

7. Marescalchi, for Emilia.

8. Marconi, for Venice.